The larval development of the portunid crab *Macropipus pusillus* (Leach) reared in the laboratory

A. L. Rice

Institute of Oceanographic Sciences, Wormley, Godalming, Surrey GU8 5UB

and

R. W. Ingle

Department of Zoology, British Museum (Natural History), Cromwell Road, London SW7 5BD

Introduction

The larval stages of *Macropipus puber* (L.) and *M. holsatus* (Fabricus) were described by Rice & Ingle (1975b) and compared with those of *M. marmoreus* (Leach), the only other species of the genus for which detailed larval descriptions were previously available (see Goldstein, 1971). A number of small, but significant, differences between the larvae of the three species were recognized and it was anticipated that similar distinctions between the larvae of all *Macropipus* species would be found when they had been examined in sufficient detail. This paper describes the larvae of a fourth species, *M. pusillus* (Leach), and reviews the diagnostic larval characters within the genus which were discussed by Rice & Ingle (1975b).

Materials and methods

An ovigerous *Macropipus pusillus* was collected off Langness Point, Isle of Man, on 23 July 1975. Hatching began on 24 July at 15 °C and was completed by the following afternoon. Larvae were reared in compartmented plastic trays and in 'mass culture' vessels using the technique described by Rice & Ingle (1975a). Development took 39 days from the beginning of hatching to the appearance of the first crab stage. Larvae and moults were fixed and preserved in a solution of propylene phenoxetol, propylene glycol and formaldehyde as formulated by Steedman (1976 : 148). Drawings and measurements were made with the aid of a *camera lucida*.

The larvae and the adult female are deposited in the British Museum (Natural History), registration number 1976: 249.

Results

The five zoeal stages (I–V) and the megalopa of *M. pusillus* are illustrated in Figs 1–6. No detailed descriptions of these stages are given since the larval characters are generally very similar to those of the previously described *Macropipus* species. Instead, the larval stages of *M. pusillus* and of the other adequately described species, i.e. *M. marmoreus* (Goldstein, 1971) and *M. puber* and *M. holsatus* (Rice & Ingle, 1975b), are compared directly in Tables 1 & 2.

Discussion

The zoeae of *M. puber* can be readily distinguished from those of the other three species by the rather stout, straight and relatively long dorsal carapace spine. In *holsatus*, *marmoreus* and *pusillus* this spine is slender, curved and short. In the early stages the zoeae of *puber* are also much larger than those of the other three species, while from stage III *puber* is easily recognized by the reduction and ultimate loss of one of the three spines on each telson fork.

Bull. Br. Mus. nat. Hist. (Zool.) **33** (4): 231–296 Issued 27 April 1978

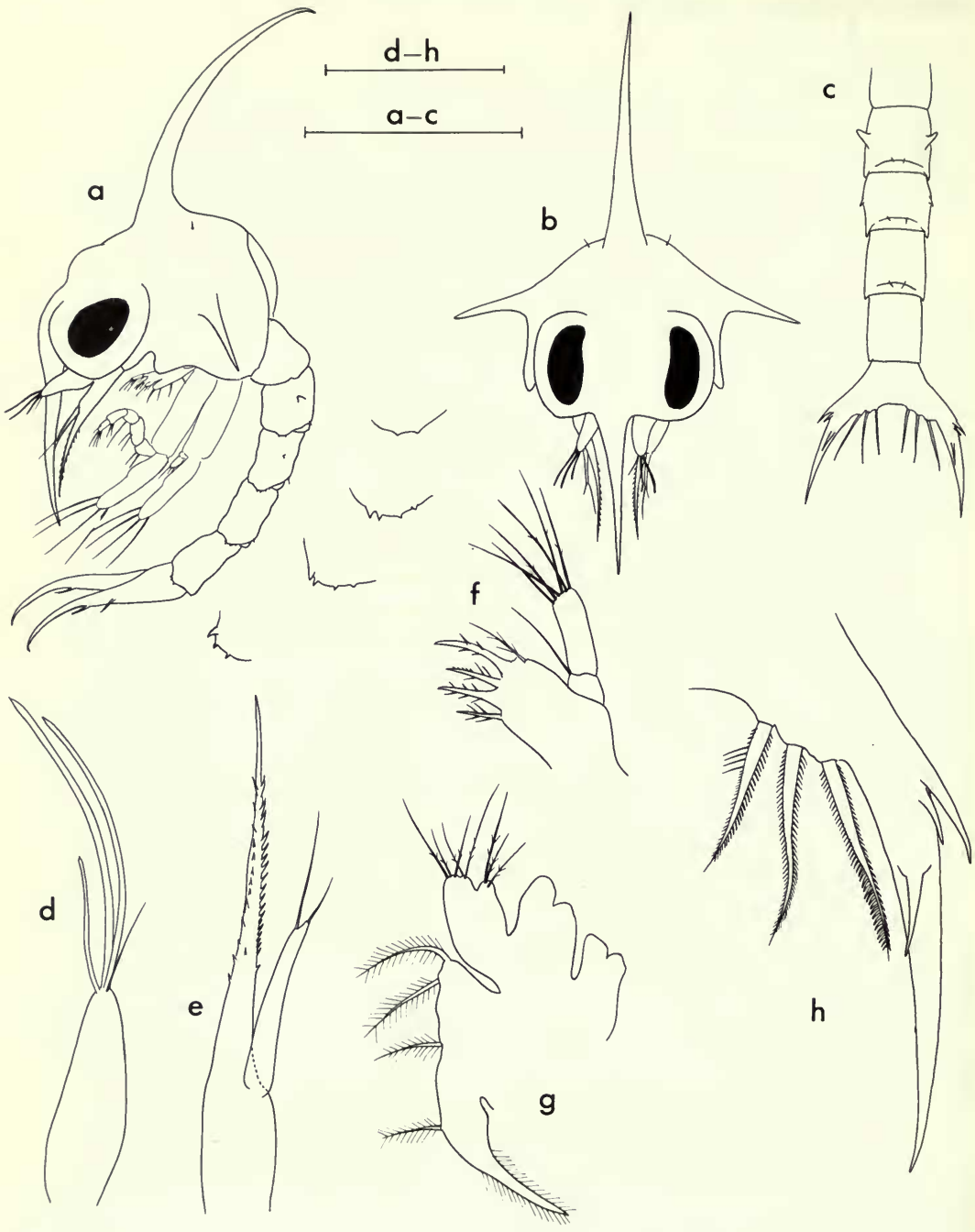

Fig. 1 *Macropipus pusillus*, first zoea; (a) lateral view, (b) anterior view, (c) abdomen, (d) antennule, (e) antenna, (f) maxillule, (g) maxilla, (h) telson. Scale represents 0·5 mm for a–c and 0·1 mm for d–h.

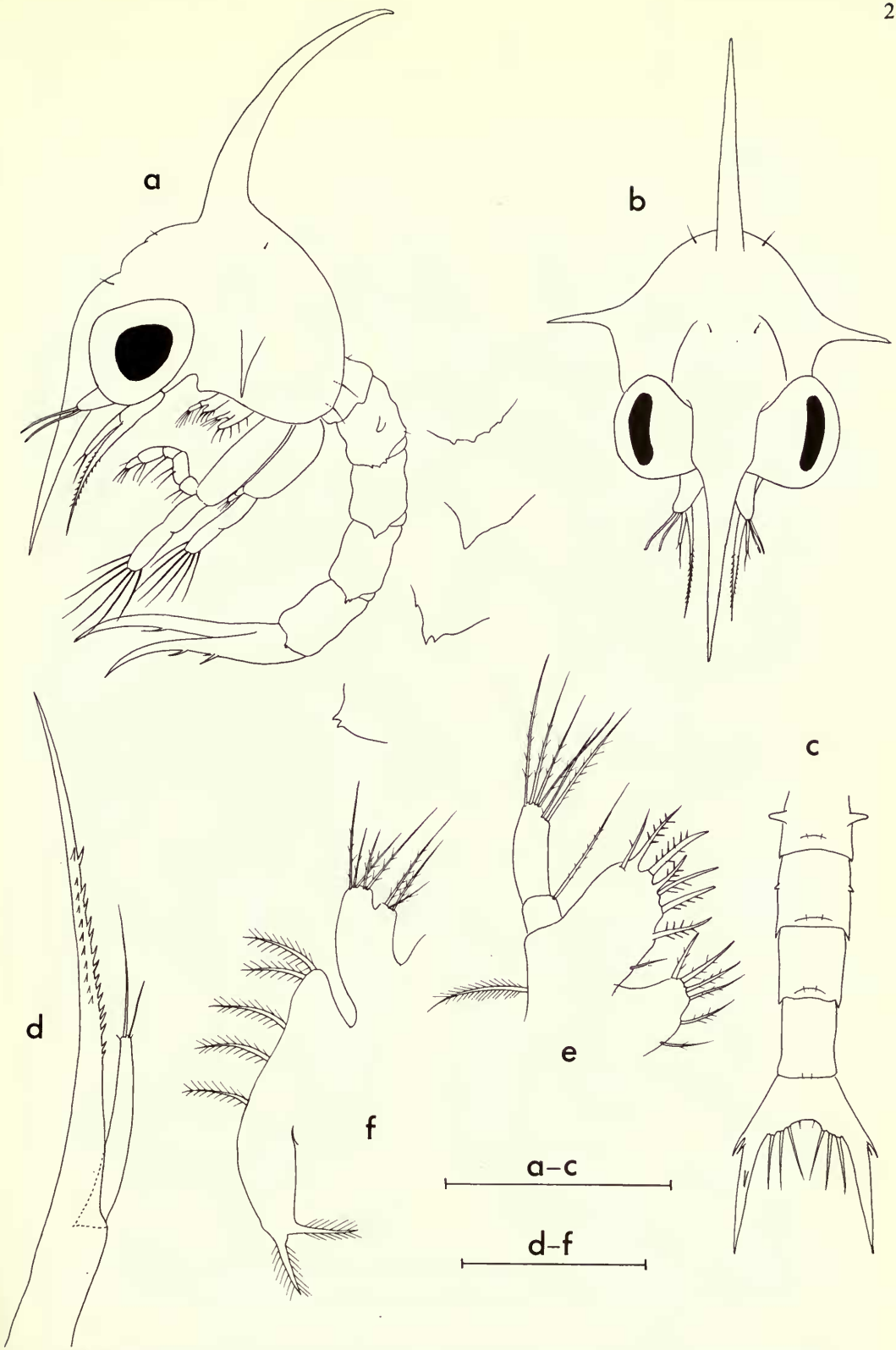

Fig. 2 *Macropipus pusillus*, second zoea; (a) lateral view, (b) anterior view, (c) abdomen, (d) antenna, (e) maxillule, (f) maxilla. Scale represents 0·5 mm for a–c and 0·1 mm for d–f.

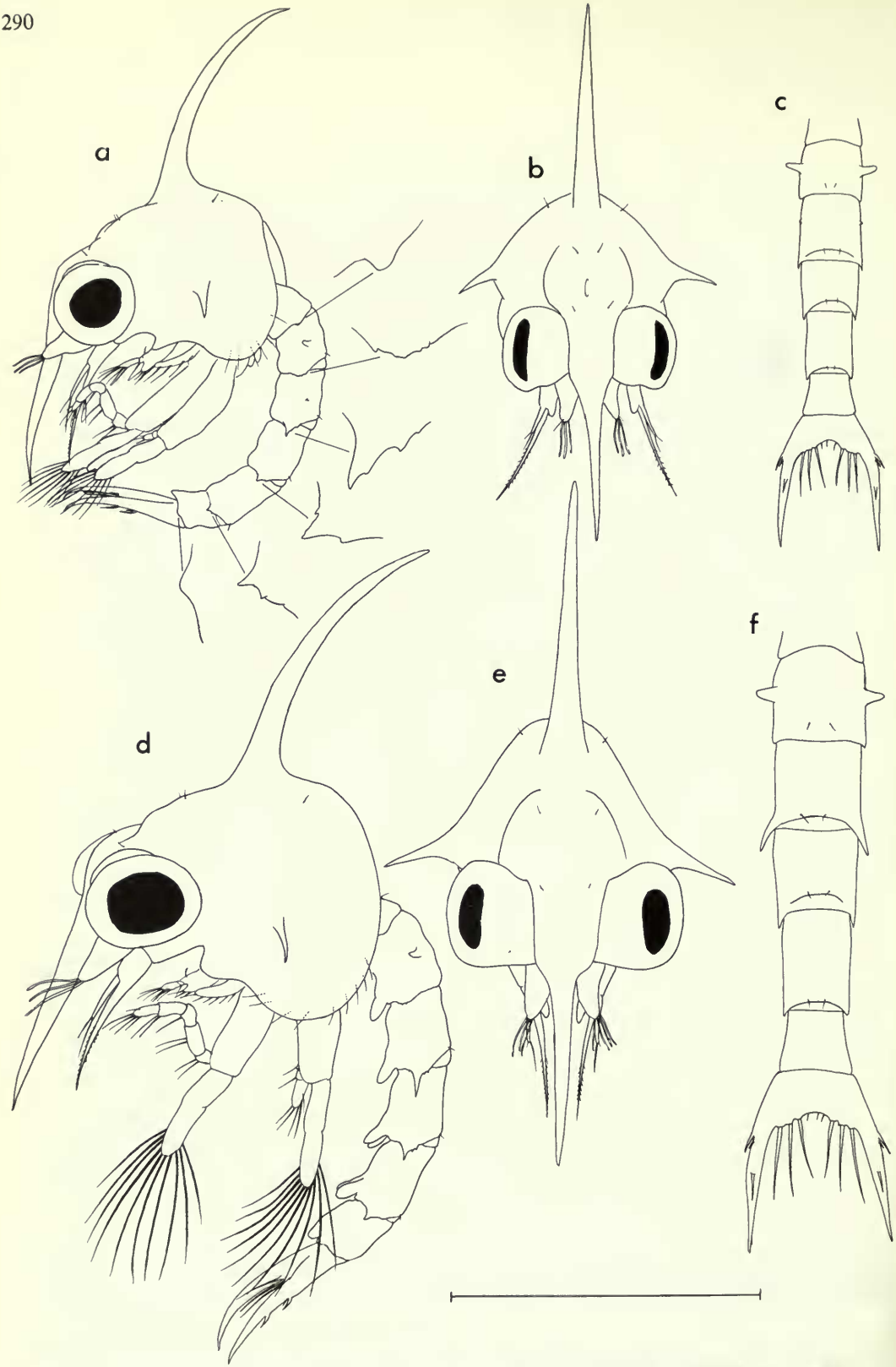

Fig. 3 *Macropipus pusillus;* (a), (b) and (c) lateral view, anterior view and abdomen, third zoea; (d), (e) and (f) lateral view, anterior view and abdomen, fourth zoea. Scale represents 1·0 mm.

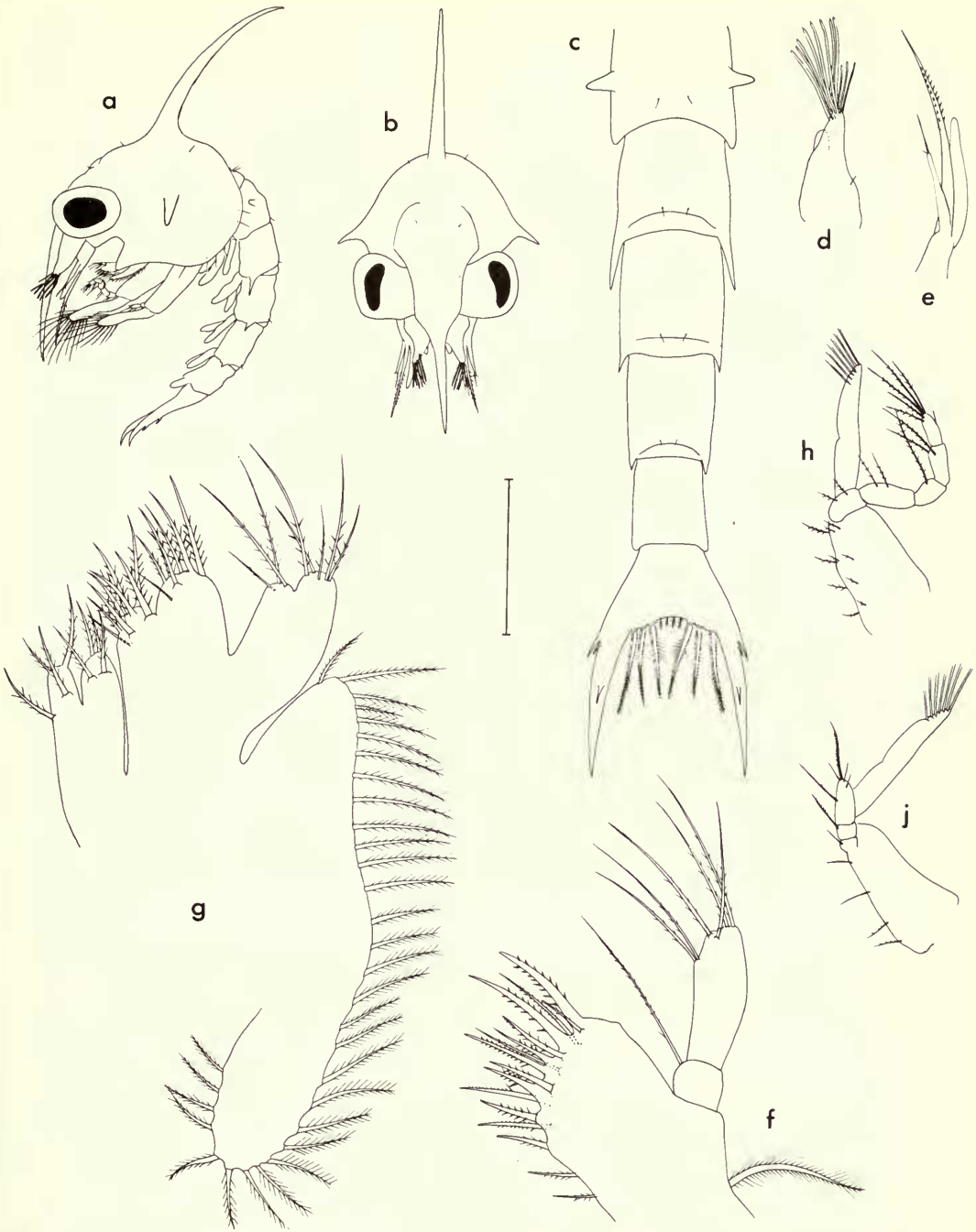

Fig. 4 *Macropipus pusillus*, fifth zoea; (a) lateral view, (b) dorsal view, (c) abdomen, (d) antennule, (e) antenna, (f) maxillule, (g) maxilla, (h) first maxilliped, (j) second maxilliped. Scale represents 1·0 mm for a and b, 0·1 mm for f and g and 0·4 mm for the remainder.

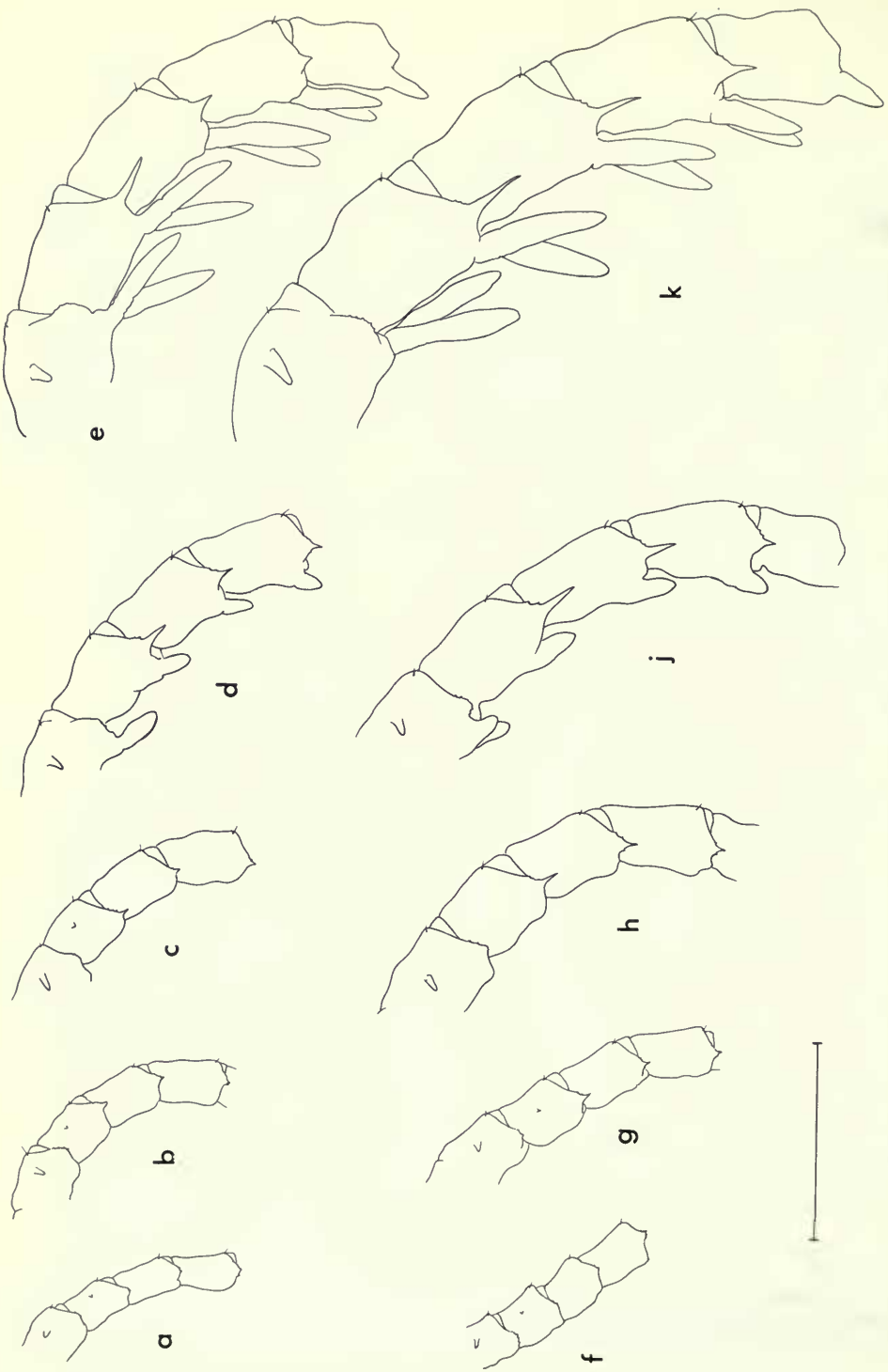

Fig. 5 *Macropipus pusillus* (a–e) and *M. holsatus* (f–k); lateral view of abdomens of first to fifth zoeae respectively. Scale represents 0·5 mm.

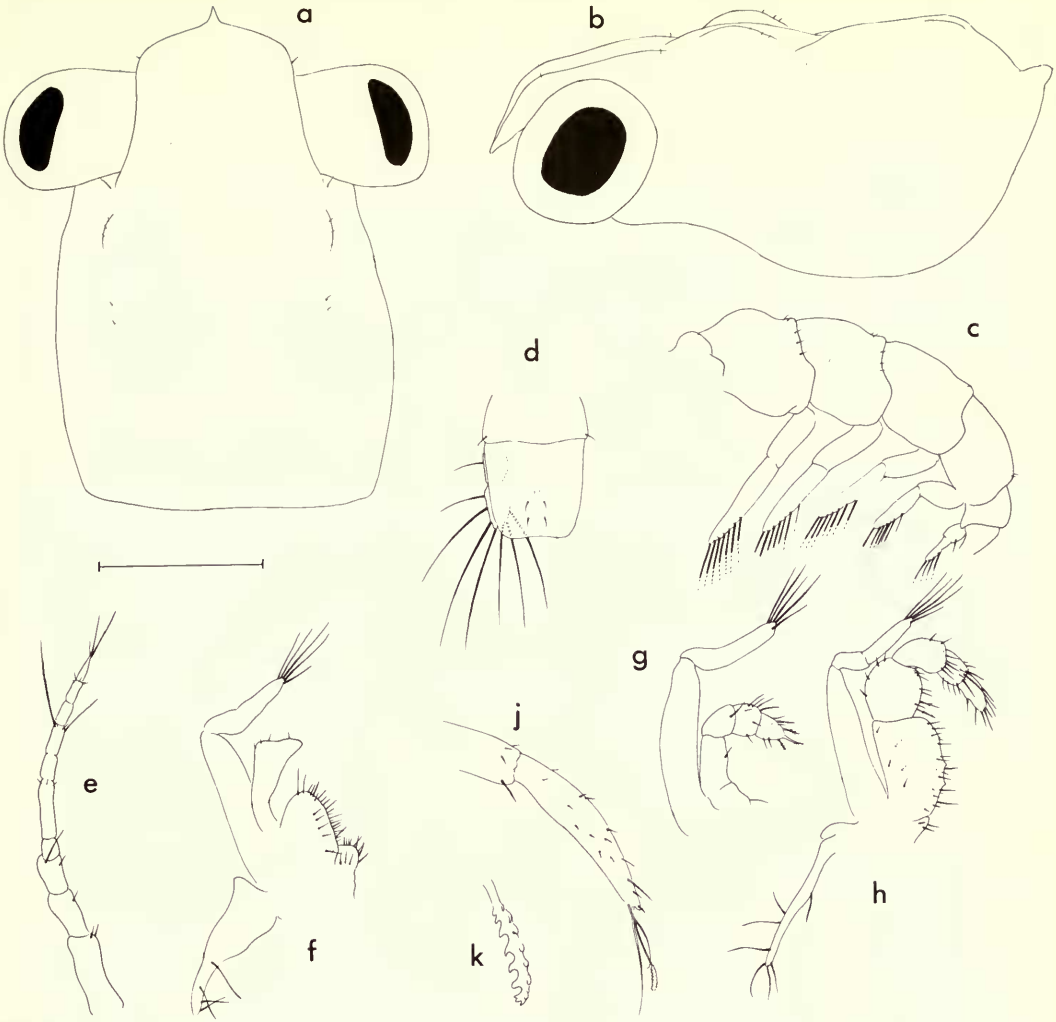

Fig. 6 *Macropipus pusillus*, megalopa; (a) carapace, dorsal view, (b) lateral view, (c) abdomen, (d) telson, (e) antenna, (f), (g) and (h) first, second and third maxillipeds, (j) dactyl of fifth pereiopod, (k) tip of sensory seta. Scale represents 0·5 mm for a–j and 0·1 mm for k.

There is, however, no single feature, by which all stages of *holsatus*, *marmoreus* and *pusillus* can be separated and different characters must therefore be used at different stages of development. Thus, from stage III *pusillus* is significantly smaller than either of the other species, while in stages III–V the posterio-lateral processes on the abdominal somites are poorly developed in *pusillus*, moderately developed in *holsatus* and prominent in *marmoreus*, In stage III the lateral process on the third abdominal somite is *present* only in *pusillus*, while in stage II it is *absent* only in *marmoreus*. In stages I and II the length of the antennal spinous process, relative to the rostrum, is much less in *marmoreus* than in either *holsatus* or *pusillus*, and *marmoreus* also has fewer setae on the basipodite of the first maxilliped.

Finally, zoeal stages I and II of *holsatus* and *pusillus* are very difficult to separate. In stage II the only difference noted was the presence of 8 marginal setae on the scaphognathite in *pusillus* compared with 11 in *holsatus*. In the first zoeal stage a pair of anterior and posterior carapace setae are present in *holsatus*, but the anterior pair could not be detected on *pusillus* and, if present, must be considerably smaller than those of *holsatus*.

Table 1 Comparison of the zoeal stages of *Macropipus puber*,[1] *holsatus*,[1] *marmoreus*[2] and *pusillus*

	M. puber	*M. holsatus*	*M. marmoreus*	*M. pusillus*
Stage I (Figs 1 and 5)				
Dorsal carapace spine (also in later stages)	Stout, straight	Slender, curved	Slender, curved	Slender, curved
Tip of dorsal to tip of rostral spine (mm)	1·90–2·20	1·10–1·30	1·10–1·24	1·18–1·34
Anterior carapace setae	Present	Present	?	Absent
Posterior carapace setae	?	Present	?	Present
Antenna: spinous process	<3/4 rostrum	>3/4 rostrum	<3/4 rostrum	>3/4 rostrum
First maxilliped: basipodite setae	10	10	6	10
Stage II (Figs 2 and 5)				
Tip of dorsal to tip of rostral spine (mm)	2·20–2·50	1·40–1·60	1·40	1·43–1·58
Antenna: spinous process	<3/4 rostrum	>3/4 rostrum	<3/4 rostrum	>3/4 rostrum
First maxilliped: basipodite setae	10	10	8	10
Maxilla: scaphognathite marginal setae	11	11	11	8
Abdominal somite 3: lateral process	Present	Present	Absent	Present
Abdominal somites 3–5: posterio-lateral margins	Not prominent, none more than 1/4 length of succeeding somite	As *puber*	Prominent, those of somite 3>1/4 length of somite 4	As *puber*
Stage III (Figs 3 and 5)				
Tip of dorsal to tip of rostral spine (mm)	3·00–3·30	1·90–2·20	1·70	1·66–1·76
Abdominal somite 3: lateral process	Absent	Absent	Absent	Present
Abdominal somites 3–5: posterio-lateral margins	Short, those of somites 3 & 4 <1/4 length of succeeding somites	Long, those of somites 3 & 4 >1/4 length of succeeding somites	Long, those of somite 3 *c.* 1/3 length of somite	Short, those of somites 3 & 4 <1/4 length of succeeding somites
Telson fork spines	Usually 2	3	3	3
Telson posterior marginal setae	4 pairs	4–5 pairs	5 pairs	4 pairs
Stage IV (Figs 3 and 5)				
Tip of dorsal to tip of rostral spine (mm)	3·40–3·60	2·60–2·90	2·00	2·11–2·25
Abdominal somite 3: posterio-lateral margin	*c.* 1/4 somite 4	1/3–1/2 somite 4	>1/2 somite 4	*c.* 1/3 somite 4
Abdominal somite 4: posterio-lateral margin	*c.* 1/4 somite 5	>1/3 somite 5	*c.* 1/3 somite 5	<1/3 somite 5
Telson fork spines	2	3	3	3

[1]Data from Rice & Ingle (1975b), and a re-examination of the material.
[2]Data from Goldstein (1971).

Table 1 (*cont.*)

	M. puber	*M. holsatus*	*M. marmoreus*	*M. pusillus*
Stage V (Figs 4 and 5)				
Tip of dorsal to tip of rostral spine (mm)	3·80–4·10	3·00–3·50	3·70	2·54–2·78
Abdominal somite 3: posterio-lateral margin	< 1/3 somite 4	*c.* 1/2 somite 4	> 1/2 somite 4	1/3–1/2 somite 4
Abdominal somite 4: posterio-lateral margin	*c.* 1/3 somite 5	1/3–1/2 somite 5	> 1/3 somite 5	< 1/4 somite 5
Abdominal somite 5: posterio-lateral margin	< 1/4 somite 6	*c.* 1/3 somite 6	*c.* 1/3 somite 6	< 1/4 somite 6
Telson fork spines	2	3	3	3

In an earlier paper Rice & Ingle (1975b) mistakenly suggested that the absence of the posterior pair of dorsal setae might be one of the distinguishing features of larvae belonging to the subfamily Portuninae, since in the larvae of *M. puber* and *M. holsatus* (Polybiinae) and in *Carcinus maenas* and *C. mediterraneus* (Carcininae) (see Rice & Ingle, 1975a) only a pair of anterior dorsal setae had been reported. On re-examination, however, the zoeae of *M. holsatus* were all found to have both an anterior and a posterior pair of setae and the proposal has proved to be unfounded.

Rice & Ingle (1975b) found differences between the megalopae of *M. puber*, *holsatus* and *marmoreus* in the form of the antenna, the telson, the dactyl of the fifth pereiopod, and in the setation of the uropods. These same features can be used to distinguish the megalopa of *M. pusillus* (see Table 2).

Table 2 Comparison of the megalopa stages of *Macropipus puber*, *holsatus*, *marmoreus* and *pusillus*

	M. puber	*M. holsatus*	*M. marmoreus*	*M. pusillus*
Carapace length (mm)	1·66–2·09	1·86–2·16	*c.* 2·0	1·67–1·93
Antennal flagellum	Seven segments, the fifth bearing 2 long setae	Eight segments	Six segments, the long setae on the third	Seven segments, the long setae on the fourth
Dactyl of fifth pereiopod	Length > 5 times maximum width. Sensory setae clearly subterminal	Length *c.* 4 times maximum width. Sensory setae almost terminal	As holsatus	Length *c.* 5 times maximum width. Sensory setae almost terminal
Telson, dorsal setae	3 pairs	2 pairs	4 pairs	2 pairs
Exopods of uropods, marginal setae	8–10	9 or 10	8	7 or 8
Exopods of pleopods on somites 2–5, marginal setae	17–19, 16–19, 17–18, 13–15	17–20, 19–20, 18–19, 14–16	?	14–17, 14–16, 13–15, 12–14

With the description of the development of *M. pusillus*, the larval morphology of half the British species of this genus is now known in considerable detail. The difficulties experienced in distinguishing between the larvae of the four described species, particularly in the early stages, may indicate the need for an even more detailed study if all species of the genus are to be recognized through all the larval stages.

Acknowledgements

We wish to thank Dr A. Fincham for collecting the ovigerous female of *M. pusillus* and Mr J. F. Peake for suggesting improvements to the manuscript.

References

Goldstein, B. 1971. Développement larvaire de *Macropipus marmoreus* (Leach) en laboratoire (Crustacea, Decapoda, Portunidae). *Bull. Mus. natn. Hist. nat. Paris*, **42** : 919–943.

Rice, A. L. & Ingle, R. W. 1975a. The larval development of *Carcinus maenas* (L.) and *C. mediterraneus* Czerniavsky (Crustacea, Brachyura, Portunidae) reared in the laboratory. *Bull. Br. Mus. nat. Hist.* (Zool.) **28** (4) : 101–119.

—— —— 1975b. A comparative study of the larval morphology of the British portunid crabs *Macropipus puber* (L.) and *M. holsatus* (Fabricus), with a discussion of generic and sub-familial larval characters within the Portunidae. *Bull. Br. Mus. nat. Hist.* (Zool.) **28** (4) : 121–151.

Steedman, H. F. (ed.) 1976. Zooplankton fixation and preservation. *In: Monographs on oceanographic methodology*. 350 pp. Paris.